MSNE 402/502 Mechanical Properties of Materials
Fall 2019, MWF 11-11:50 AM, MEB 128

Instructor: Dr. Jun Lou, MEB 223, jlou@rice.edu, Ext. 3573
Office hour: MWF 11:50-12:30 or by appointment

Synopsis:
This course covers basic aspects of mechanical properties of solid materials. Topics include structure of materials, fundamentals of elasticity and plasticity, dislocation theory and strengthening mechanisms, fracture mechanics and failure mechanisms, fatigue mechanisms and life prediction methodologies, composites and some other special cases such as resistant curve behavior and creep problems. The course will also introduce students to techniques for characterization of structure and properties of solid materials at different length scales, and some recent developments in experimental and modeling methods to study the mechanical behavior of materials at micro- and nano- scales.

Scope and Course objectives:
This course is intended to emphasize structure-property relationships of materials, and materials theories and some conceptual aspects not often introduced in solid mechanics classes. The materials covered will be in depth and will be applied to various engineering problems to emphasize your understanding and future application of the knowledge. It is also intended to stimulate students' interest in the advanced research of mechanical behavior of materials across different length scales.

Text:
M. A. Meyers and K. K. Chawla, Mechanical Behavior of Materials, Cambridge University Press, UK 2009. Specific reading assignments will be given in class.

Reference:
R. W. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, Fourth Edition, Wiley, NY 1996
N. E. Dowling, Mechanical Behavior of Materials, Second Edition, Prentice-Hall, Inc., NJ 1999
G. E. Dieter, Mechanical Metallurgy, Third Edition, McGraw-Hill, NY 1986
S. Suresh, Fatigue of Materials, Second Edition, Cambridge, 1998
J. Weertman and J. R. Weertman, Elementary Dislocation Theory, Oxford, 1992

Grading:
MSCI 402: HW 30% Quiz I 10% Quiz II 10% Short Essay 10% Lab Attendance 5% Final 35%
MSCI 502: HW 30% Quiz I 10% Quiz II 10% Term Paper 15% Final 35%

Website of the course:
Go to https://canvas.rice.edu/courses/24004
Sign in use your NetID and normal password.

Homework policy:
Assignments will normally be due **at 5PM** one week from the day of assignments unless otherwise notified by the instructor or indicated in the course schedule. Students should feel free to discuss homework problems with others but should always present their own work. **No late homework** will be accepted, please seek approval from the instructor for special conditions **before the deadline**.

Short Essay Guideline (MSNE 402 students only)
Objective: The primary objective of the short essay is to encourage students to explore the contemporary developments in the field of mechanical properties of solid materials, especially at the micro- and nano-scales.
Short Essay: The short essay must state clearly the motivation behind your chosen topic. You should explain the uniqueness or the significance of the topic that you are interested in. You should also indicate the ***relevance*** of the work to this course. The short essay should be no more than **3** pages including figures and references. The minimum font size is 11.
Some Examples: The students are highly encouraged to further explore contemporary research topics that are covered in the special lectures in this course. A review of a recently published paper is appropriate.

Term Paper Guideline (MSNE 502 student only)
Objective: The primary objective of the term paper is to explore applications of the basic concepts learned from this course to real engineering problems. The secondary objective is to stimulate the interests in current cutting edge research in the field of mechanical properties of materials.
Approach: The following steps are recommended for the successful completion of your term paper in the 15-week period.

(a) Develop a one page abstract of what you would like to do (first 7 weeks)
(b) Schedule a meeting with professor to discuss the assessment of your plan and also to develop a working plan for the second half of the semester (week 8 and 9)
(c) Carry out the working plan and complete the term paper (week 10-15)
(d) You are encouraged to meet with professor to discuss problems and consult any available resources you can find

Term paper: The term paper must state the objective and motivation of your work clearly. You should explain the uniqueness or the significance of the work that you are interested in. You should also indicate the ***relevance*** of the work to this course. The term paper should contain the following sections and no more than **10** pages including figures:
Abstract
Introduction and motivation
Brief description of the work that your are interested in
Analysis/Experimental work to verify your idea
Results and discussions
Summary and concluding remarks
Suggestions for future work
Acknowledgment
Reference

Some examples:
Materials properties and selection for wind turbine blades; Mechanical aspects of trabecular bone; Mechanics of baseball bats; Mechanical properties and behavior of carbon nanotubes in polymer; Survey of a particular kind of equipment/technique; Literature review/analysis of some recent exciting work published in scholarly journal;

Honor Code
Both quizzes and the final exam will require the honor pledge.
The term paper will require the honor pledge.

Student with Disabilities
Any student with a disability requiring accommodations in this course is encouraged to contact me after class or during office hours. Additionally, students should contact Disability Support Services Office in the Allen Center.